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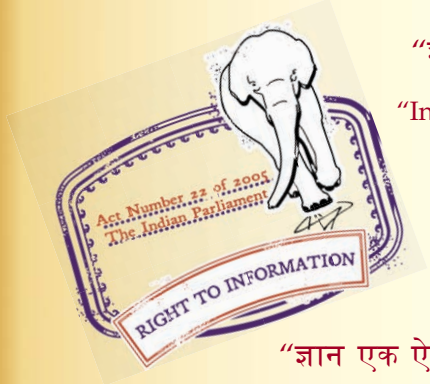

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IS : 10373 - 1982

(Reaffirmed 2005)

Indian Standard

SPECIFICATION FOR PLASTIC BOXES FOR SAFETY MATCHES

UDC 662·536·2 : [678·746·22]

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4

April 1983

Indian Standard

SPECIFICATION FOR PLASTIC BOXES FOR SAFETY MATCHES

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Indian Standard

SPECIFICATION FOR PLASTIC BOXES FOR SAFETY MATCHES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 17 November 1982, after the draft finalized by the Safety Matches Sectional Committee had been approved by the Consumer Products and Medical Instruments Division Council.

0.2 Many outstanding features are responsible for making polystyrene one of the most popular plastics which is used for manufacturing plastic boxes for safety matches. Since the basic material is colourless the polymer can be made crystal-clear or in an unlimited range of colours from transparent to opaque. Excellent dimensional stability combined with negligible moisture absorption and freedom from warping or distortion within the thermal operating range make polystyrene useful where moulding to close tolerances is required. Its resistance to corrosive chemicals, such as acids (except oxidizing acids), alkalis, salts, and lower alcohols is outstanding. Electrical properties are exceptionally good over the whole range of frequencies in practical use. The high impact polystyrene or rubber-modified polystrene is characterised by improved shock resistance and increased elongation while still retaining reasonably good electrical and mechanical properties. That is why this material is used for manufacturing of plastic boxes.

0.3 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This standard covers requirements and methods of tests for plastic boxes for safety matches.

*Rules for rounding off numerical values (*revised*).

2. TERMINOLOGY

2.1 Match Box — The container in which match sticks reach the ultimate consumer; it mostly consists of an outer part carrying the striking surface and an inner tray carrying the matches.

2.2 Impact Strength — Impact strength is the ability of the material to withstand blows.

2.3 Tensile Strength — Tensile strength is the maximum load sustained by the test specimen under specified conditions divided by the minimum original cross sectional area of the specimen.

2.4 Elongation — Elongation is the extent to which the test bar stretches before it completely fails and is expressed as a percentage of the original gauge length of the test specimen.

3. DIMENSIONS

3.1 The thickness of sheet for the outer cover of the match box shall be 0·5 mm *Min* and for inner tray 0·8 mm *Min.*

3.2 The preferable size of the outer cover and the inner tray shall be:

i) For the inner tray: 50 × 32 × 13 mm, and

ii) For the outer cover: 53 × 35 × 15 mm.

4. MATERIAL

4.1 The material used for making the match box shall be high impact polystyrene having melting point between 175 and 200°C.

NOTE — It is a high impact strength material for injection moulding, extrusion and forming consisting of rubberized polystyrene with or without colourants and lubricants.

5. REQUIREMENTS

5.1 The material used shall be of uniform composition. The material may be compounded with colourants and lubricants, if desired by the purchaser.

5.1.1 The material shall comply with the requirements given in Table 1.

5.2 Finish — The outer surface of the outer cover and inner tray of the match box shall be of smooth appearance and free from defects, such as lines and local depressions.

TABLE 1 REQUIREMENTS FOR POLYSTYRENE MOULDING MATERIALS

(*Clause* 5.1.1)

Sl No.	Characteristic	Requirement	Method of Test, Ref to Appendix
(1)	(2)	(3)	(4)
i)	Impact strength, kg-cm/cm notch, *Min*	4·0	A
ii)	Tensile strength, kgf/cm^2 (yield), *Min*	200	B
iii)	Elongation, percent, *Min*	15	B
iv)	Flexural strength, kgf/cm^2	450 to 570	C

5.3 Colour — If the match box is coloured, the colouring matter used shall be well dispersed and the surface of the match box shall be free from colour streaks. The colour shall not fade when dipped in 25 percent salt water (NaCl solution) at 27 $\pm$ 2°C for 48 hours.

5.4 Friction Surface — There shall be a coated strip of suitable chemicals on the two narrow sides of the match box for striking the matches. It shall terminate at 1 to 3 mm from each edge of the shorter sides of the box and none shall appear on the inside of the box.

5.5 Wearing Strength of Friction Surface — Each friction surface of a match box shall be capable of igniting 100 match sticks conforming to IS : 2653-1980* when struck on it. The match box shall be conditioned at a temperature of 27 $\pm$ 2°C and relative humidity of 65 $\pm$ 5 percent for one hour before carrying out this test.

5.6 The broken cracked and crushed boxes in the test sample shall not exceed 5 percent.

5.7 Loosely fitted match boxes shall not exceed one percent.

5.7.1 *Procedure* — Fill the box with 50 match sticks made of wood and hold the closed, filled match box, vertically in hand. Observe whether the inner tray falls out of the box by itself. If the tray falls down it will be termed as loosely fitted match box.

6. MARKING

6.1 Plastic boxes for safety matches shall indicate the name or registered trade-mark of manufacturer. In addition the pack/carton shall also indicate the number of match boxes in the pack/carton alongwith month and year of production.

*Specification for safety matches in boxes (*first revision*).

6.1.1 The plastic boxes may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

7. SAMPLING

7.1 Sampling of plastic boxes shall be as agreed to between the purchaser and the supplier. A suitable sampling plan is given in Appendix D.

APPENDIX A

(*Table* 1)

DETERMINATION OF IMPACT STRENGTH

A-1. OUTLINE OF THE METHOD

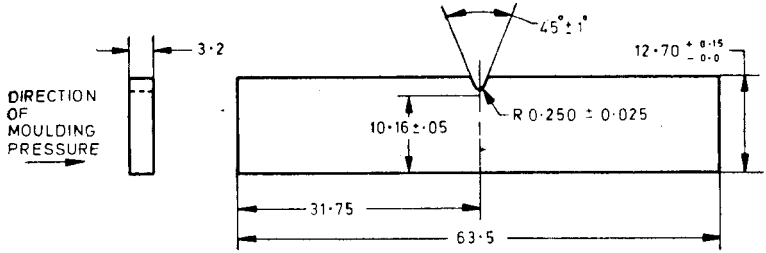
A-1.1 The specimen is mounted in an Izod type impact testing machine and energy required to fracture the specimen in one knock is measured.

A-2. APPARATUS

A-2.1 Izod Type Impact Machine — The machine shall be of the pendulum type or rigid construction, and accurate to 0·15 kg.cm for reading of less than 15 kg.cm and to 1 percent for higher values. The pendulum of the machine shall be capable of release from such a position that the linear velocity of the centre of the striking edge at the instant of impact shall be approximately 335 cm/s. The striking edge of the pendulum shall be tapered to have an included angle of 45° and shall be rounded to a radius of 3·2 mm.

A-2.2 Micrometer Caliper — Capable of measuring to the nearest 0·2 mm.

A-2.3 Notching Tool — Notching tool may be of the single-tooth or multi-tooth variety. The cutting edge shall be carefully ground and honed to ensure sharpness and freedom from nicks and burrs. The profile of the cutting tooth (teeth) shall be such as to produce in the test specimen at right angles to its principal axis a notch of the contour and depth specified in Fig. 1.



All dimensions in millimetres.

FIG. 1 TEST SPECIMEN FOR IMPACT STRENGTH

A-2.4 Torque Wrench — Capable of tightening the screw on specimen holder to 17·25 kg.cm of torque.

A-3. TEST SPECIMEN

A-3.1 Dimensions — 63·5 × 12·7 × 3·2 mm (*see* Fig. 1).

A-3.2 Preparation of the Test Specimen

A-3.2.1 *Moulding* — Test specimen shall be flat sections of plastics of not less than 2·3 mm and not more than 4·2 mm thickness, preferably compression moulded.

A-3.2.2 *Notching* — The specimen shall be notched as shown in Fig. 1. The included angle of the notch shall be 45 ± 1° with a radius of curvature at the apex as 0·250 ± 0·025 mm. The plane bisecting the notch angle shall be perpendicular to the face of the test specimen with a tolerance of 2°.

A-3.2.3 *Conditioning* — The specimen shall be conditioned in an atmosphere of 27 ± 2°C for a minimum period of 30 minutes.

A-4. PROCEDURE

A-4.1 Subject five test specimens to test. Clamp the test specimen rigidly with centre line of the notch on the level of top of the clamping surface and strike the blow on the notched side. Tighten the clamping bolt to 17·25 kg.cm of torque using the torque wrench. Break the bars and record the reading after each break.

A-5. EXPRESSION OF RESULTS

A-5.1 Calculate the average of the individual scale readings. Subject the correction factor for friction and windage. Divide the corrected reading by the average bar thickness. Report impact strength in kg.cm/cm notch.

APPENDIX B

(*Table* 1)

DETERMINATION OF TENSILE STRENGTH AND ELONGATION

B-1. APPARATUS

B-1.1 Testing machine of the constant rate of crosshead movement type, and comprising essentially of the following:

a) A fixed member carrying one of the grips;

b) A movable member carrying second grip;

c) Two self-aligning grips capable of holding the specimen securely;

d) A drive mechanism for imparting to the movable member a uniform controlled velocity with respect to the stationary member; and

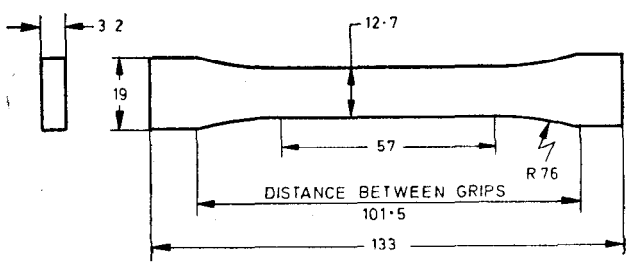
e) A suitable load indicator mechanism capable of showing the total tensile load carried by the test specimen when held by the grips.

B-1.2 Extension Indicator — A suitable instrument for determining the distance between the marks of the gauge length of the test specimen at any time during the test.

B-1.3 Micrometer Calipers — Capable of measuring to the nearest 0 02 mm.

B-2. TEST SPECIMEN

B-2.1 Dimension — Test specimens shall be prepared by compression moulding and shall conform to Fig. 2.



All dimensions in millimetres.

FIG. 2 SPECIMEN FOR TENSILE STRENGTH

B-2.2 Conditioning of Specimen — The specimens shall be conditioned in an atmosphere of 27 ± 2°C for a minimum period of 30 minutes.

B-3. PROCEDURE

B-3.1 Measure width and thickness of each bar to the nearest 0·02 mm with micrometer. Calculate cross-sectional area for each bar. Maintain the speed of testing at 5 to 6·5 mm per minute. Place the specimen in the grips of the testing machine. The ends of the gripping surfaces shall be minimum 100 mm apart. Record maximum load at yield and extension at the moment of rupture.

B-4. EXPRESSION OF RESULTS

B-4.1 Tensile Strength — Calculate the tensile strength from the formula:

$$\text{Tensile strength kgf/cm}^2 = \frac{\text{Load in kg at yield}}{\text{Original cross-sectional area in cm}^2}$$

B-4.2 Elongation — Calculate the percent elongation by dividing extension at the moment of rupture of the specimen by the original distance between gauge marks and multiply by one hundred.

B-4.3 Report — Report the mean of five results.

APPENDIX C

(*Table* 1)

DETERMINATION OF FLEXURAL STRENGTH

C-0. GENERAL

C-0.1 Flexural stress at a given moment is the maximum fibre stress of the material in the section of the test specimen directly under load. The flexural strength of the specimen shall be found out by the modulus of elasticity from load-deflection curve plotted.

C-0.1.1 Flexural stress at conventional deflection is the flexural stress at a deflection conventionally fixed at 1·5 times the height of the test specimen.

C-0.1.2 Flexural stress at maximum load and flexural stress at rupture respectively are at that moment when the load reaches a maximum value and at the moment of rupture.

C-1. APPARATUS

C-1.1 Testing Machine — A standard testing machine, properly constructed and calibrated, which can be operated at an approximately constant rate of cross-head movement and in which error for indicated loads which are recorded should not exceed ± 1 and for deflection ± 2 percent.

The radii of the load nose (r_1) and the supports (r_2) are:

$r_1 = 5 \pm 0{\cdot}1$ mm, and

$r_2 = 2 \pm 0{\cdot}1$ mm.

C-2. PREPARATION OF SPECIMENS

C-2.1 The specimens shall be 80 mm or more, in length (L), $10 \pm 0{\cdot}5$ mm in breadth and the thickness equivalent to the thickness of the sheet under test.

C-2.1.1 *Number of Test Specimens* — There shall be a minimum of five test specimen subject to the condition that the results of five of them do not show a larger deviation from the arithmetical mean than twice the standard deviation.

C-2.1.2 Test specimens that are broken outside the middle third part shall be discarded.

C-2.1.3 When the material shows a significant difference in flexural properties in two principal directions, it shall be tested in these two directions.

C-2.2 Conditioning — Keep the test specimens at 27 ± 2°C for at least 96 hours and conduct the test in the same atmosphere.

C-3. PROCEDURE

C-3.1 Measure the breadth and height to the nearest 0·1 and 0·02 mm respectively, and adjust the distance of L_V (*see* Fig. 3) to 16 times the height of specimen ±0·5 mm. Load the specimen as a simple beam at mid span. Load the test specimen without bumping. Read the load and deflection and plot the load-deflection curve.

NOTE — The deflection is most accurately measured by means of a dial micrometer placed at the centre of the lower surface of the specimen.

C-3.1.1 For test specimens that break before or at the moment of reaching the deflection prescribed in **C-0.1.1**, record the load and deflection at break.

C-3.1.2 For test specimens that do not break at deflection prescribed in **C-0.1.2**, record the load causing this deflection and maximum load.

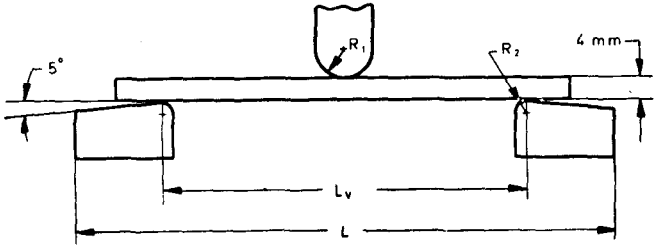


FIG. 3 TESTING DEVICE FOR FLEXURAL STRENGTH

C-4. CALCULATION

C-4.1 Calculate the modulus of elasticity and flexural strength as follows :

'The modulus (E) is determined in the elastic linear initial range of the load-deflection curve by reading off at least five values for the deflection of the test specimen and the force required.'

$$E_B = \frac{L_V^3}{4bh^3} \times \frac{F}{\Upsilon}, \text{ and}$$

$$\sigma FB = \frac{3\,FL_V}{2\,bh^2}$$

where

E_B = modulus of elasticity, kgf/cm^2;

L_V = distance of supports, cm;

b = breadth of test specimen, cm;

h = height of the test specimen, cm;

F = load for a chosen point of straight part of load-deflection curve;

Υ = deflection caused by F, cm; and

σFB = flexural stress at rupture, kgf/cm^2.

C-4.2 Report

C-4.2.1 The report shall include the following:

a) Dimensions of the test specimens and of the applied span,

b) Flexural stress at rupture and deflection when the test specimens have broken,

c) Flexural stress at the conventional deflection and flexural stress at maximum load, and

d) The load-deflection curve and the modulus of elasticity calculated from the linear part of this curve.

C-4.2.2 The mean of the five determinations shall be taken as the representative values of flexural stress for test sample.

APPENDIX D

(Clause 7)

SAMPLING PLAN FOR PLASTIC BOXES FOR SAFETY MATCHES

D-1. LOT

D-1.1 In a consignment, all the plastic boxes made from the same material, under similar conditions of manufacture, shall be grouped together to constitute a lot.

D-1.2 Samples shall be taken and tested from each lot. The number of samples to be selected shall depend on the size of the lot and shall be in accordance with col 1 and 2 of Table 2.

TABLE 2 SAMPLE SIZE AND ACCEPTANCE NUMBER

Lot Size	For Finish, Dimensions and Friction Surface Test		Tests for Impact Strength, Tensile Strength, Elongation (%) Flexural Strength and Wearing Strength of Friction Surface	
	Sample Size	Acceptance Number	Sample Size	Acceptance Number
(1)	(2)	(3)	(4)	(5)
Up to 1 000	80	5	20	1
1 001 to 3 000	125	7	32	2
3 001 to 10 000	200	10	50	3
10 001 to 35 000	315	14	80	5
35 001 and above	500	21	125	7

D-1.2.1 The boxes shall be selected from the lot at random. In order to ensure the randomness of selection, procedures given in IS : 4905-1968* may be followed.

D-2. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

D-2.1 All the boxes selected at random according to col 1 and 2 of Table 2 shall be examined for finish, dimensions and subjected to the test for friction surface. A box failing to satisfy any of these tests shall be termed as defective.

D-2.1.1 The lot shall be considered as conforming to these requirements if the number of defectives found in the sample is less than or equal to the corresponding acceptance number given in col 3 of Table 2; otherwise the lot shall be rejected.

D-2.2 The lot which is found as conforming to the above requirements, shall then be examined for the broken, cracked and crushed boxes and loosely fitted boxes. For this purpose, the sample size shall be in accordance with col 1 and 2 of Table 2. The lot shall be considered as conforming to the requirements if **5.6** and **5.7** are satisfied; otherwise the lot shall be rejected.

D-2.3 The lot which is found as conforming to the requirements of **D-2.1** and **D-2.2** shall then be tested for impact strength, tensile strength, elongation(%), flexural strength and wearing strength of friction surface. For this purpose, the sample size and the acceptance number are given in col 4 and 5 of Table 2.

*Methods for random sampling.